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ELEMENTARY SCHOOL SCIENCE TEXTBOOKS: A FRAMEWORK FOR ANALYSIS

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ABSTRACT

The present paper is an attempt to look at the present status of school science textbooks at elementary stage with respect to the content they cover, their focus with respect to achieving the basic objectives of science teaching and to understand how the content drives the pedagogy employed by the teachers. It also throws light on the relevance of a science textbook to emphasise critical areas of scientific literacy along-with the need to understand science as a process. The paper further identifies the categories on the basis of which Science Textbooks should be analysed to understand the weaknesses and strengths of the current science textbooks at Elementary stage.

KEYWORDS: Scientific Literacy, Process Skills, Curriculum Reform.

Textbooks and Science Education: An Introduction

A key problem, throughout the world in improving elementary school science, centers around the questions "What should we teach? What do we want children to learn? How should we teach? " It compels us to examine first the question of what we mean by science. Do we regard as a body of knowledge to be discovered by scientists and transmitted to our children? Or do we regard it as system of inquiry, a way of looking at the world? Or does our philosophy embrace both these positions? Our answer to such questions will obviously colour the kind of science education which we envisage for our children and which we translate into practical action in form of curricula, materials, teacher training programmes and classroom teaching. If we look back at some of the major curriculum projects of the last two decades taken up by various countries, it is clear that each had a philosophical position with regard to this issue. Two extreme positions can be called, "content oriented" and "process oriented". Here, process means the intellectual skills and the attitude required to find things out or approach problem scientifically. Most of the recently produced curriculum programmes do not lie at extreme ends of the content-process continuum. Whatever the case may be, it must be accepted that content has to be a vehicle for process and attitude goals. It seems that the criteria to be used for selecting content are often one or more of the following:

- That it is close to children, engaging their interest and curiosity.
- That it particularly lends itself to inquiry method and so helps to promote process skills.
- That it develops concepts, which help children understand their environment and are needed for science studies in subsequent education.

Choosing topics from the children's environment is fine in many cases, but it has to be remembered that nature in the law is not simple. The factors affecting phenomena encountered in everyday life are often complex. Not all subject matter, which is relevant to everyday lives, can be explained using science processes – take matter of safety, some aspects of the working of human body, the movement of sun, moon and stars. Similarly, it is important to include content, which introduces children at an early age to technology.

Unfortunately, the selection of content is a subject that often squeezes out the discussion of process. Achieving process objectives depends on "how" rather than "what" activities are pursued. The "how" is perhaps even more vital to the realization of the goals of science education than the "what", since it is possible to cover content without using science processes, but it is not possible to use processes without some content. Thus, attention to the way of teaching is essential if elementary science is to meet the expectations, which are claimed for it. There have been various attempts worldwide to constantly improve the situation of science teaching at the elementary level. In what follows, we describe the various projects and discuss their impact on improving science education in different countries of the world.

Of course, curriculum reform is of vital importance as we respond to the current challenge for reform in science education for the 90s. However, real reform may not be possible when we start with curriculum per se. Perhaps an analogy is appropriate.

The curriculum is a vehicle for getting the job done; it is like choosing a vehicle for a trip. Can we choose one or create one without knowing where we want to go? Is every vehicle equally good for every trip we want to take? Can curriculum reform really occur without first deciding where we want it to go?

We need science education as a discipline – one capable of raising basic questions, one, which offers possible explanations, and finally one, which is willing to test the explanations offered and to share the results of such testing with others.

A Method to Quantify Major Themes of Scientific Literacy in Science Textbooks

Science Textbooks have long been an object of interest and concern among science educators. These teaching aids are widely used in science courses; thus they convey a great deal of the scientific information that students receive. Most importantly, these instructional materials influence how students and their teacher perceive the scientific enterprise. Unfortunately, many science teachers rely heavily on the assigned text, which probably gives students a false impression of the nature of science. Many of the commercially available texts stress facts and present science as a complete body of information that was derived in errorless manner. Science textbooks place too much emphasis on terminology and vocabulary, which results in students memorizing large amounts of information and giving it back on tests.

Obviously, science textbooks play a very important role in science teaching; consequently this teaching aid should be as useful as possible. Science textbooks must convey a valid conception of the scientific enterprise. In the process of making science as relevant as possible, these teaching aids must relate science to the everyday lives of students without compromising the integrity of the field of study. Science textbooks can be interesting to students and at the same time illustrate how science, technology, and society are interrelated.

Categories for Analyzing Science Textbooks

Scientific literacy is the ability of the general population to understand the basic concepts related to science. The dimensions of scientific literacy that has been categorized are:

1. The knowledge of science. Check this category if the intent of the text is to present, discuss, or ask the students to recall information, facts, concepts, principles, laws, theories, etc. It reflects the transmission of scientific knowledge where the student receives information. This category typifies most textbooks and presents information to be learned by the reader. Textbook material in this category:

   (a) Presents facts, concepts, principles and laws.

   (b) Present hypotheses, theories, and models.

   (c) Ask students to recall knowledge or information.

2. The investigative nature of science. Check this category if the intent of the text is to simulate thinking and doing by asking the students to "find out." It reflects the active aspect of inquiry and learning, which involves the students in the methods and processes of science such as observing, measuring, classifying, inferring, recording data, making calculations, experimenting, etc. This type of instruction can include paper and pencil as well as hands-on activities. Textbook material in this category:

(a) Requires students to answer a question through the use of materials.

(b) Requires students to answer a question through the use of charts, tables, etc.

(c) Requires students to make a calculation.

(d) Requires students to reason out an answer.

(e) Engages students in a thought experiment or activity.

However, if question simply asks for recall of information or is immediately answered in the text.

3. Science as a way of thinking. Check this category if the intent of the text is to illustrate how science in general or a certain scientist in particular, went about "finding out". This aspect of nature of science represents thinking, reasoning, and reflection, where the student is told about how the scientific enterprise operates. Textbook material in this category includes the following aspects:

(a) Describe how a scientist experimented.

(b) Shows the historical development of an idea.

(c) Emphasizes the empirical nature and objectivity of science.

(d) Illustrates the use of assumptions.

(e) Shows how science proceeds by inductive and deductive reasoning.

(f) Gives cause and effect relationships.

(g) Discusses evidence and proof.

(h) Presents the scientific method and problem solving.

4. Interaction of science, technology, and society. Check this category if the intent of the text is to illustrate the effect or impacts of science on society. This aspect of scientific literacy pertains to the application of science and how technology helps or hinders humankind. In addition, it involves social issues and careers. Nevertheless, the students receive this information and generally do not have to find out. Textbook material in this category:

(a) Describes the usefulness of science and technology to society,

(b) Points out the negative effects of science and technology on society,

(c) Discusses social issues related to science or technology, and

(d) Mentions careers and jobs in scientific and technological fields.

CONCLUSION:

Among the great ironies of our culture is that science, a fundamentally open-ended and exploratory activity, is frequently taught so much as a body of "facts" that many students become estranged from science, and most are deprived of an opportunity to have experiences which strengthen and reinforce their own inclination to experiment, question, and explore ... both the world outside and themselves.

Teachers must continually emphasize the significance of keeping science textbooks in the classroom. They must inform students that science is the key to understanding the world as well as discovering other wonders of the universe. Students must recognize that scientific literacy is found in the contents of science textbooks.

There appears to be a void in the research related to science teacher's perception of the textbook. Little research has focused on the teacher's views on the textbook in terms of its ability to encourage critical thinking and facilitate the processing of information.

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